

MO THfcJ BASIC OPKN-IKAITII STKKL ITiOdKSS

special purposes, *,//., silicon, aluminium, nickel, chromium, etc and it is desirable as much as possible only to make these additions after deoxidation, in so far as their physical properties do not forbid, and (as with aluminium or high percentage ferro-silicon) make the addition only during running out into the ladle.

(f) PIlHNOMHNA IN CASTING ANI> Soi,II>I KH'ATION.

Steel has, in common with most substances, the property of occupying more space in the molten state than in the solid state. It, therefore, contracts on setting.

In the production of ingots, steel is cast into thick walled cast iron moulds, which rapidly absorb heat, from the molten metal, and bring it to setting point at its exterior more rapidly than in the interior. The set portions shrink further on cooling but to less extent than the molten interior on setting and therefore cavities or faulty places must originate in the ingots.

Most fusible materials exhibit these properties, and H. M. Howe and Bradley Stoughton have established the same phenomena, which appear in steel ingots, in test ingots, of stearic acid (see reference in "Stahl und Eisen," 1908, p. 118), and enabled them to render clear the cause of the same experimentally. The most essential conditions which determine size, state, and position of the cavities are the following: The absolute size of the cavities is dependent on the degree of the superheating with which the molten material reaches the mould, and increases with the superheating.

If the cooling down in the mould is at an equal rate throughout and progresses in the direction from outside to inside, the material sets in layers parallel to the walls of the mould, and originates a cavity which lies in the axis of the ingot and comes to an end at a certain length, somewhat as shown in Fig. 17.

But if chilling takes place unequally, so that only the bottom and side layers solidify whilst the upper portion remains liquid, this fluid material will sink down and hinder the formation of the cavity, and the entire defect of the material